IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of T. NETSCH, et al.	) Examiner: P. MEHTA)) Art Unit: 3737)) Confirmation: 3792
Serial No.: 10/538,448	)
Filed: June 10, 2005	))
For: **GENERATING A STACK OF CURRENT SLICE IMAGES WHICH ARE ALIGNED WITH AN EARLIER GENERATED STACK OF SLICE IMAGES OF THE SAME REGION (As Amended)**	)))))))))
Date of Last Office Action: June 18, 2010	)))
Attorney Docket No.: PHDE020303US1 / PKRZ 201391US01	) Cleveland, OH 44114) November 12, 2010

APPEAL BRIEF

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an Appeal from the Final Office Action of June 18, 2010.

The Notice of Appeal and requisite fee were filed September 17, 2010.

An authorization to charge the 37 CFR 41.20(b)(2) Appeal Brief fee of $540 to the applicant's Deposit Account accompanies this brief.

TABLE OF CONTENTS

(i)   REAL PARTY IN INTEREST

        The Real Party in Interest is the Assignee, KONINKLIJKE PHILIPS ELECTRONICS, N.V.

(ii)   RELATED APPEALS AND INTERFERENCES

None.

(iii) STATUS OF CLAIMS

Claims 1-10, 12-13 and 15-19 are pending.

Claims 11 and 14 are cancelled.

Claims 1-13, and 15-19 stand rejected.

No claims stand allowed, confirmed, withdrawn, or objected to.

The rejection of all claims, including claims 1-10, 12-13 and 15-19, is being appealed.

(iv) STATUS OF AMENDMENTS

Amendment E (After Final) of September 17, 2010 has been entered.

An Amendment accompanies this Appeal Brief which corrects a minor typographical issue and simplifies the issues on Appeal by cancelling claim 11 and does not go to the scope of the claims.   It is believed that this accompanying Amendment will be entered as reducing the issues on Appeal.

(v) SUMMARY OF CLAIMED SUBJECT MATTER

1. A method of tomographic imaging, and particularly a CT or MR method, for repetitively producing diagnostic slice images of a part of a patient's body, {p. 2, l. 27-34; p. 3, l. 1-19} comprising:

a) making at least first and second current reference slice images of the part of the body, the first and second current reference slice images being in first and second reference slice image planes having first and second positions and first and second orientations that are differently oriented by an angular offset; {p. 2, l. 27-34; p. 3, l. 1-19; p. r, l. 22-28; p. 5, l. 25 – p. 6, l. 2; Fig. 1, Fig. 2}

b) determining a geometrical transformation by which the first and second positions and orientations of the current reference slice images are brought into agreement with positions and orientations of at least first and second earlier reference slice images of the part of the body, the first and second earlier reference slice images being in first and second image planes having first and second positions and first and second orientations that are differently oriented by said angular offset, {p. 2, l. 27 – p. 4, l. 21; p. 5, l. 25 – p. 6, l. 2; Figs. 1 & 2}

c) calculating current imaging parameters by transforming earlier imaging parameters with the geometrical transformation, {p. 6, l. 8-12; Fig. 1}

d) controlling a tomographic scanner to make a series of current diagnostic slice images, positions and orientations in three dimensions of image planes of the series of current diagnostic slice images being determined by the calculated current imaging parameters, the position and orientation of the current diagnostic slice images being in agreement with positions and orientations in three dimensions of corresponding slice images of a series of prior diagnostic slice images of the part of the patient's body. {p. 5, l. 15-21; Fig. 1}

2. The method as claimed in claim 1, wherein determining the geometrical transformation includes:

identifying reference points in the current reference slice images that agree with corresponding reference points in the earlier reference slice images. {p. 3, l. 20-32}

5

3.   The method as claimed in claim 1, wherein the geometrical transformation includes a rigid or an affine transformation that is defined by a set of transformation parameters, the set of transformation parameters being determined automatically by a suitable algorithm, optimizing a measure of similarity that represents the similarity of the current reference slice images to the corresponding earlier ones. {p. 3, l. 33 – p. 4, l. 7}

4.   The method as claimed in claim 1, wherein the earlier reference slice images include at least two parallel slice images in each of head-foot, anterior-posterior and right-left directions. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

5.   A non-transitory computer-readable medium carrying a computer program which controls a computer to perform a method, which automatically determines imaging parameters by which a position and orientation in three dimensions of an image plane of a diagnostic slice image are determined, the method {p. 4, l. 29-33} comprising:

a) receiving at least two current reference slice images which are perpendicular to each other and at least two earlier reference slice images which are perpendicular to each other, {p. 2, l. 27-34; p. 3, l. 1-19; p. r, l. 22-28; p. 5, l. 25 – p. 6, l. 2; Fig. 1, Fig. 2}

b) determining a geometrical transformation by which the at least two current reference slice images are simultaneously brought into alignment with the at least two earlier reference slice images, {p. 2, l. 27 – p. 4, l. 21; p. 5, l. 25 – p. 6, l. 2; Figs. 1 & 2}

c) calculating current imaging parameters by transforming earlier imaging parameters by the geometrical transformation, {p. 6, l. 8-12; Fig. 1} and

d) controlling an imager using the current imaging parameters to generate a series of parallel current diagnostic images. {p. 5, l. 15-21; Fig. 1}

6.   A tomographic imaging system {9} comprising:

an image-making means {10} for making diagnostic slice images; {p. 6, l. 3-7; Fig. 1}

6

a computer {11} that operates the image-making means and calculates imaging parameters that determine particular positions and orientations in three dimensions of image planes of diagnostic slice images made by the image-making means {p. 4, l. 29-34; p. 6, l. 3-7; Fig. 1}, the computer being programmed to perform the steps of:

receiving at least two earlier reference slice images having a first position and non-parallel orientation relative to each other, the at least two earlier reference images being made using earlier imaging parameters; {p. 2, l. 27-34; p. 3, l. 1-19; p. r, l. 22-28; p. 5, l. 25 – p. 6, l. 2; Fig. 1, Fig. 2}

controlling the image-making means to make at least two current reference slice images which have the first position and said non-parallel orientation relative to each other; {p. 2, l. 27-34; p. 3, l. 1-19; p. r, l. 22-28; p. 5, l. 25 – p. 6, l. 2; Fig. 1, Fig. 2}

calculating a geometric transform that transforms the at least two current reference images into alignment with the at least two earlier reference images; {p. 2, l. 27 – p. 4, l. 21; p. 5, l. 25 – p. 6, l. 2; Figs. 1 & 2}

operating on the earlier imaging parameters with the calculated geometric transform to generate current imaging parameters; {p. 6, l. 8-12; Fig. 1}

controlling the image-making means to generate a plurality of parallel current diagnostic slice images using the current imaging parameters. {p. 5, l. 15-21; Fig. 1}

7.   The computer-readable medium as claimed in claim 5, wherein determining the geometrical transform further includes:

with a computer algorithm, maximizing a similarity measure that represents a similarity between the current reference slice images and the earlier reference slice images. {p. 4, l. 8-21}

8.   The tomographic imaging system as claimed in claim 6, wherein

the at least two earlier reference slice images {3, 3'} are oriented orthogonal to each other, {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2} and

the at least two current reference slice images {1, 1'} are oriented orthogonal to each other. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

9.   reference slice images and a first of the current reference slice images are transformed into alignment oriented along one of foot-head, anterior-posterior, and left-right directions and a second of the earlier slice references and a second of the current reference slice images are transformed into alignment oriented along a different one of the foot-head, anterior-posterior, and left-right directions. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

10.   An imaging system for the production of diagnostic slice images of a patient, the system comprising:

an imaging unit {9, 10} which makes at least two current reference slice images of the patient, the current reference slice images being oriented along at least two of head-foot, anterior-posterior, and left-right directions; {p. 2, l. 27-34; p. 3, l. 1-19; p. r, l. 22-28; p. 5, l. 25 – p. 6, l. 2; Fig. 1, Fig. 2}

a transform unit {2, 3, 4} that determines a geometrical transformation which aligns the current reference slice images and at least two earlier reference slice images that are oriented along the at least two of the head-foot, anterior-posterior, and left-right directions; {p. 2, l. 27 – p. 4, l. 21; p. 5, l. 25 – p. 6, l. 2; Figs. 1 & 2}

a computer {11} programmed to automatically calculate current imaging parameters by transforming earlier imaging parameters by the geometrical transformation and to operate the imaging unit {9} using the current imaging parameters to set a position and orientation of an image plane in three dimensions and to generate a plurality of diagnostic slice images oriented in parallel image planes. {p. 5, l. 15-21; Fig. 1}

12.   The system as claimed in claim 10, wherein the earlier {3, 3'} and current reference slice images {1, 1'} each include at least two reference slice images oriented parallel to the parallel image planes and at least two reference slice

8

images oriented perpendicular to the parallel image planes. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

13.   The system as claimed in claim 12, wherein the earlier reference slice images {3, 3'} and the current reference slice images {1, 1'} each include at least two reference slice images oriented in a head-foot direction, an anterior-posterior direction, and a right-left direction. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

15.   The method as claimed in claim 1, wherein the current reference slice images are orthogonal to each other and the earlier reference slice images are orthogonal to each other. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

16.   The method as claimed in claim 1, wherein:
        the first current {1} and earlier reference {3} slice images are brought into agreement in one of a head-foot direction, an anterior-posterior direction, and a
        left-right direction, {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2} and
        the second current {1'} and earlier reference {3'} slice images are brought into agreement in a different one of the head-food direction, the anterior-posterior direction, and the left-right direction than the first current and earlier reference slice images, such that the angular offset is 90°. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

17.   The method as claimed in claim 15, wherein the first and earlier reference slice images are brought into alignment with the head-foot direction and the second current and earlier reference slice images are brought into alignment with the anterior-posterior direction and further including a third current reference slice image and a plurality of third earlier reference slices images and further including:
        bringing the third current and earlier reference slice images into alignment with the head-foot direction. {p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2}

18.　　The method as claimed in claim 1, wherein a resolution of the first earlier {3} and current {1} reference slice images is different from a resolution of the second earlier {3'} and current {1'} reference slice images. {**p. 3, l. 1-19**}

19.　　The method as claimed in claim 1, further including a plurality of first earlier reference slice images and a plurality of second earlier slice images and further including:

　　aligning all of the first earlier and current reference slice images; {**p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2**}and

　　aligning all of the second earlier and current reference slice images. {**p. 4, l. 22-28; p. 6, l. 8-12; Fig. 2**}

Whether claims 1, 4-10, 12-13, 15-17, and 19 distinguish patentably in the sense of 35 U.S.C. § 103 over what the Examiner refers to as AAPA.

Whether claims 2 and 3 distinguish patentably under 35 U.S.C. § 103 over AAPA as modified by Grimson (US 5,531,520).

Whether claim 18 distinguishes patentably in the sense of 35 U.S.C. § 103 over AAPA as modified by Oldroyd (US 6,738,532).

The AAPA, as understood, is page 1, line 27 – page 2, line 21 of the present application, specifically:

For this purpose, it is usual for reference slice images of the part of the body to be made before the actual diagnostic slice image is made. By calculating a geometrical transformation, it is possible for a fresh, current reference slice image that is made to be brought into congruence with earlier reference slice images. The method that is required for this purpose is a method of optimization in which the sets of image data for the reference slice images made at different times are brought into agreement. From the geometrical transformation that is calculated, transformation parameters are obtained that are taken as a basis for calculating current imaging parameters. For diagnostic slice images, the current imaging parameters are then used to enable the image planes of the diagnostic slice images to be set repeatably (see for example J.M. Fitzpatrick, D.L. Hill and C.R. Maurer Jr.: "Chapter 8: Image Registration" in M. Sonka and J.M. Fitzpatrick (eds.) "Handbook of Medical Imaging, Volume 2: Medical Image Processing and Analysis", pages 447-513, SPIE Press, Bellingham WA, 2000; J.B.Maintz and M.A. Viergever: "A Survey of Medical Image Registration", Medical Image Analysis, Vol. 2(1), pages 1-36, 1998).

It is a disadvantage of the known methods that the accuracy obtained in calculating the imaging parameters is often not high enough. A particular reason for this is that the accuracy with which the geometrical transformation is determined is very much dependent on the presetting of the image planes of the reference slice images, because the resolution of the image

11

in the image plane that is preset is, as a rule, considerably greater than in a direction perpendicular thereto. Because of the time required to make the reference slice images, it is not possible, and this is a disadvantage, for image data to be acquired, as part of the making of the reference slice images, with adequate resolution in all three dimensions. What would be needed for this purpose would be high-resolution volumetric imaging, something that is not possible in practice.

It should be noted that the Examiner has declined to rely on the Fitzpatrick, et al. or Maintz, et al. references set forth in the AAPA and has relied instead on the summary thereof on page 1, line 27 – page 2, line 7.

(vii) ARGUMENT

A.   Claim 1 and Claims 2-4 & 15-19 Dependent Therefrom Distinguish
         Patentably Over the References of Record

It is often advantageous to monitor the treatment or progression of a disease by generating high resolution volumetric images of a region or organ of a patient affected by the disease. One common example is monitoring the growth of a tumor while treatment options are weighed and monitoring shrinkage of the tumor (hopefully) during treatment.

One could try to place the patient in the diagnostic imaging apparatus in exactly the same imaging position each time. If the resultant high resolution 3D images are accurately combined, the clinician can step through the images, e.g., in a ciné mode, to monitor the progress of the disease or the treatment. The 3D high resolution images, when generated by CT or MRI, can have a resolution on the order of a millimeter or less along all three axes.

Unfortunately, as hard as the technician might try, it is very rare to be able to position the patient in the exact same position, within a millimeter in all directions, for each of the varying imaging sessions. Thus, when the clinician tries to view a corresponding slice image from the series of 3D images, the tumor or other structure of interest moves back and forth and up and down witin the image slice, and moves into and out of the image slice.

As an aside, one could transform each of the high resolution 3D images into spatial alignment. One could transform the current 3D image into alignment with the first of the series of 3D images. This has two disadvantages. First, performing a transform on an image reduces the resolution due to various combining or averaging operations in the transform process. Second, if the transform is non-linear, the current image could be warped by the transform, raising questions of positional accuracy. As a first alternative, one could transform each of the prior images into alignment with the current image. This would maintain the resolution of the current image, but would reduce the resolution of the prior images. But, transforming so many volumetric images would be time intensive. As a third alternative alluded to at page 2, lines 17-21 of the present application (a portion of the AAPA), one could determine the transform between the earlier image and the current

13

image. But, instead of transforming the image, one can use the transform to modify the scan parameters. The current high resolution image can then be thrown away and a new high resolution current image can be generated with the transformed scan parameters such that the new current high resolution image is inherently aligned with the original high resolution 3D reference image. As pointed out on page 2, lines 20-21 of the present application, this third alternative is just not practical. Acquiring a second current high resolution image can use a significant amount of expensive diagnostic scanner time. In the case of CT images, it doubles the patient's radiation exposure.

As set forth at the beginning of the AAPA, others have proposed to address this problem by generating a current reference slice image (page 1, line 29) instead of a current high-resolution volumetric current image. Keeping in mind that the high resolution 3D image might be a stack of 512, 1024, or the like slice images, generating a single current reference slice image greatly reduces x-ray exposure (CT) and reduces imaging time. The AAPA then proposes to align the current reference slice image with the earlier reference slice images taken at the earlier imaging times. It should be noted that if the current and earlier reference slices images are all in exactly the same plane, then the slice images can be simply translated side-to-side or up and down, rotated (in plane), or the like to be brought into alignment. However, there is a problem when the current and reference slices images do not lie in a common plane. When they do not lie in a common plane, they are of different parts of the patient and there is a very significant lack of data available to bring the planes into alignment.

As alluded to on page 2, lines 12-17, instead of taking a single current reference slice image, one could generate a few parallel current slice images. When these current slices images are stacked, they form an effective 3D volume image, which has high resolution in-plane and much lower resolution in the direction perpendicular to the planes. This enables one to develop a three-dimensional transform between the effective 3D volume defined by the few stacked, parallel current reference images and a corresponding stack of a few parallel earlier reference images. This again has the disadvantage of compromised accuracy in determining the transform with respect to the reference slice images.

14

As set forth on page 2, lines 22-26 of the present application as filed, it is an object of the present application to allow more accurate calculation of the imaging parameters with only a minimal image making time for making the reference slice images.

Claim 1 calls for making at least first and second current reference slice images which are in first and second planes, which first and second planes are differently oriented by an angular offset. As the Examiner acknowledges, the AAPA does not disclose that the reference slice images are differently oriented by an angular offset. Contrary to the Examiner's assertions, this angular offset provides more accurate calculation of the imaging parameters with only a minimal image making time for making the reference slice images (page 2, lines 22-26). Also note the inaccuracy issues with the AAPA described at page 1, line 27 – page 2, line 11.

Further, the Examiner makes the assertion that it would be obvious to introduce the new concept of reference slices at first and second reference slice images that are differently oriented by an angular offset without the courtesy of providing any teaching reference or, indeed, any rationale. The claim does not call for mere angular rotation. Rather, claim 1 calls for generating reference slices images that are angularly offset. In the diagnostic imaging arts, slice images are typically generated parallel to each other. Generating slice images at two angular orientations during a common pilot imaging session, contrary to the Examiner's assertion made in the Advisory Action, is not well-known.

Pursuant to MPEP 2144.03, the applicant hereby traverses the Examiner's assertion made in the Advisory Action that making first and second reference slices images that are differently angularly oriented by an angular offset, in the present context, is well-known and puts the Examiner to her proofs to provide appropriate reference documentation in support thereof.

Claim 1 further calls for determining a geometrical transform between first and second current reference slices images that are differently oriented by an angular offset and first and second earlier reference slice images that are differently oriented by the same angular offset. This limitation is not shown in the AAPA. The Examiner provides no explanation or teaching of this step.

15

For these and other differences, it is submitted that **claim 1 and claims 2-4 and 15-19 dependent therefrom** distinguish patentably and unobviously over the references of record.

B.   Claim 4 Distinguishes Patentably Over the References of Record

Claim 4 calls for the earlier reference slice images to include at least two parallel slice images in each of the head-foot, anterior-posterior, and right-left directions. Two or more parallel slice images in each of three orthogonal directions is not disclosed or suggested in the AAPA. The record is devoid of any reference which discloses or teaches such a combination of reference slice images. The final rejection provides only a bald assertion of "obvious" without any reference or explanatory basis.

The Examiner asserts that any slice image of the human body inherently has a specific orientation to a head-foot direction, an anterior-posterior direction, and a right-left direction. While these three directions are known in the diagnostic imaging arts, the Examiner has failed to address the claim limitation, particularly that there are at least two parallel slice images in each of the head-foot, the anterior-posterior, and the right-left directions. Rather, it is submitted, that in the prior art the slices images of a set of slice images are normally parallel to each other, often perpendicular to the head-foot direction. The Examiner has failed to provide any reference or other basis for believing that having at least two images in each of the head-foot, anterior-posterior, and left-right directions is obvious in the art.

Accordingly, it is submitted that **claim 4** distinguishes patentably over the references of record.

C.   Claims 15 & 17 Distinguish Patentably Over the References of Record

Claim 15 calls for the current reference slices images to be orthogonal to each other. The section of the AAPA relied upon by the Examiner only references a single current reference slice image, not at least two slice images, much less current reference slice images that are orthogonal to each other. Reference slice images at an angular offset to each other improve resolution in the direction orthogonal to the slice. Orthogonal reference slice images optimize this resolution. The Examiner has again

16

given no reference or explanation regarding why one of ordinary skill in the art would have found such an orthogonal orientation of reference images to be obvious.

Accordingly, it is submitted that **claim 15 and claim 17 dependent therefrom** distinguish patentably and unobviously over the references of record.

D.   Claim 16 Distinguishes Patentably Over the Prior Art

Claim 16 calls for the angular offset to be 90°. By distinction, the norm in the prior art is for the slice images to be parallel. The Examiner has failed to provide a reference or any other basis to support her assertion that orthogonal reference images are obvious.

Accordingly, it is submitted that **claim 16** distinguishes patentably and unobviously over the references of record.

E.   Claim 5 and 7 Distinguish Patentably Over the References of Record

Claim 5 calls for receiving at least two current reference images which are perpendicular to each other and determining at least two earlier references which are perpendicular to each other and determining a geometric transform which brings these pairs of orthogonal images into alignment. As the Examiner concedes, AAPA does not teach reference images which are orthogonal to each other. Rather, they are parallel to each other as is conventional in the imaging arts. The Examiner fails to cite any reference or provide any other reasoned explanation other than for the reasons set forth in the present application and claims, regarding why those of ordinary skill in the art would use orthogonal reference slice images. Parallel reference slice images, as are more typical in the art, can be stacked to create a 'volume' image which has relatively high resolution in-plane and relatively course resolution out-of-plane. Working with orthogonal reference slice images is conceptually very different from parallel reference slice images, creating a different arrangement of different reference slice image information to be used in the alignment process. Moreover, the combination set forth in claim 5 is advantageous over the AAPA in its greatly improved accuracy in the alignment of the current and earlier reference images.

17

Accordingly, it is submitted that **claim 5 and claim 7 dependent therefrom** distinguish patentably and unobviously over the references of record.

F.   Claim 7 Distinguishes Patentably Over the References of Record

In the rejection of **claim 7**, the Examiner appears to be relying upon a reference which she has not made a part of the rejection of claim 7.

Claim 7 calls for maximizing a similarity measure that represents a similarity between a current reference slice image and earlier reference slice images. This technique finds antecedent basis at page 4, lines 8-21 of the present application and relates to a different transform/alignment technique than affine transforms, which are discussed page 3, line 33 – page 4, line 7 of the present application. Page 8 of Maintz, referenced by the Examiner, discusses affine or rigid transforms, not maximizing a similarity measure. Therefore, the reference(s) cited by the Examiner fails to teach that which asserts.

Accordingly, it is submitted that **claim 7** distinguishes patentably and unobviously over the prior art.

G.   Claim 6 and Claims 8 & 9 Dependent Therefrom Distinguish
          Patentably Over the References of Record

Claim 6 calls for the two earlier reference slice images to have a non-parallel orientation relative to each other, and for the two current reference images to also have said non-parallel orientation relative to each other. As the Examiner acknowledges, the AAPA does not disclose or suggest the use of non-parallel images. Moreover, it is submitted that the AAPA does not disclose using non-parallel earlier and current images with the same non-parallel orientation relative to each other.

Because the AAPA is a very brief summary, much information is missing. As discussed above, the reference images would be parallel to each other such that they can be stacked to form a 'volume' image in which the resolution in the direction perpendicular to the parallel slices is less than the resolution in-slice.

It is submitted that contrary to the Examiner's assertions, non-parallel images are not a mere choice of design. Note that non-parallel images would not

18

stack to form the 'volume' image which has higher resolution in-plane and lesser resolution perpendicular to the plane of the slice as described in the AAPA.

Accordingly, it is submitted that **claim 6 and claims 8 and 9 dependent therefrom** distinguish patentably and unobviously over the references of record.

H.   Claim 8 and 9 Distinguish Patentably Over the Prior Art

Claim 8 calls for the earlier and current reference slices to be oriented orthogonal to each other. This orthogonal orientation of the reference slices addresses the deficiency noted at page 2, lines 15-17 that the stacked parallel images have less resolution in the direction orthogonal to the slices. Thus, the orthogonal orientation is not a mere matter of choice, but an inventively different technique which overcomes the problems with the AAPA to achieve superior results.

Accordingly, it is submitted that **claim 8 and claim 9 dependent therefrom** distinguish patentably and unobviously over the references of record.

I.   Claim 10 and Claims 12-13 Distinguish Patentably Over the References of Record

Claim 10 calls for at least two current reference slice images of the patient to be oriented along at least two of the head-foot, anterior-posterior, and left-right directions. This orthogonal orientation is not disclosed in the AAPA.

The AAPA teaches that, to the contrary, the reference slices should all be parallel to each other. This enables the reference slice images to be stacked into a volume with lower resolution in the direction orthogonal to the planes.

The generation of parallel slice images is conventional in the diagnostic imaging art. The Examiner has not shown that generating reference images of a subject along orthogonal directions is known. Moreover, no reference has been cited showing why the use of orthogonal reference images should be used or why those of ordinary skill in the art would find it obvious to go against the clear teachings of the AAPA and create orthogonal reference slice images.

Accordingly, it is submitted that **claim 10 and claims 12-13 dependent therefrom** distinguish patentably over the references of record.

19

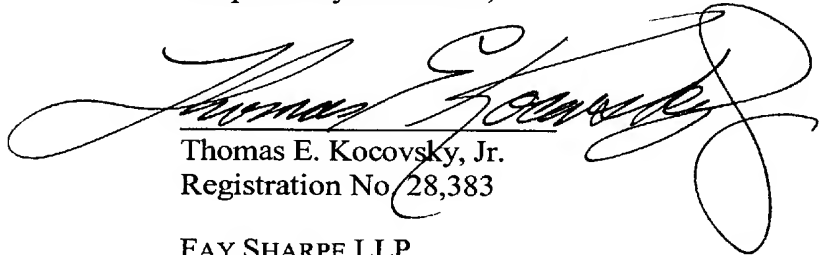J.   Claims 12 & 13 Distinguish Patentably Over the Prior Art

Claim 12 calls for at least two reference slice images oriented parallel to each other along each of the perpendicular directions. By contrast, in the AAPA, the slice images would be parallel. There is no suggestion or teaching in the AAPA that one could have parallel slice images oriented in two orthogonal directions or what one might hope to achieve by such an arrangement.

Accordingly, it is submitted that **claim 12 and claim 13 dependent therefrom** distinguish patentably and unobviously over the references of record.

K.   Conclusion

For the reasons set forth above, it is submitted that claims 1-10, 12-13 and 15-19 distinguish patentably and unobviously over the references of record. An early reversal of all of the Examiner's rejections is requested.

Respectfully submitted,

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20

(viii) CLAIMS APPENDIX

1.   (Rejected)   A method of tomographic imaging, and particularly a CT or MR method, for repetitively producing diagnostic slice images of a part of a patient's body, comprising:

a) making at least first and second current reference slice images of the part of the body, the first and second current reference slice images being in first and second reference slice image planes having first and second positions and first and second orientations that are differently oriented by an angular offset;

b) determining a geometrical transformation by which the first and second positions and orientations of the current reference slice images are brought into agreement with positions and orientations of at least first and second earlier reference slice images of the part of the body, the first and second earlier reference slice images being in first and second image planes having first and second positions and first and second orientations that are differently oriented by said angular offset,

c) calculating current imaging parameters by transforming earlier imaging parameters with the geometrical transformation,

d) controlling a tomographic scanner to make a series of current diagnostic slice images, positions and orientations in three dimensions of image planes of the series of current diagnostic slice images being determined by the calculated current imaging parameters, the position and orientation of the current diagnostic slice images being in agreement with positions and orientations in three dimensions of corresponding slice images of a series of prior diagnostic slice images of the part of the patient's body.

2.   (Rejected)   The method as claimed in claim 1, wherein determining the geometrical transformation includes:

identifying reference points in the current reference slice images that agree with corresponding reference points in the earlier reference slice images.

3.   (Rejected)   The method as claimed in claim 1, wherein the geometrical transformation includes a rigid or an affine transformation that is defined

21

by a set of transformation parameters, the set of transformation parameters being determined automatically by a suitable algorithm, optimizing a measure of similarity that represents the similarity of the current reference slice images to the corresponding earlier ones.

4.   (Rejected) The method as claimed in claim 1, wherein the earlier reference slice images include at least two parallel slice images in each of head-foot, anterior-posterior and right-left directions.

5.   (Rejected)   A non-transitory computer-readable medium carrying a computer program which controls a computer to perform a method, which automatically determines imaging parameters by which a position and orientation in three dimensions of an image plane of a diagnostic slice image are determined, the method comprising:

a) receiving at least two current reference slice images which are perpendicular to each other and at least two earlier reference slice images which are perpendicular to each other,

b) determining a geometrical transformation by which the at least two current reference slice images are simultaneously brought into alignment with the at least two earlier reference slice images,

c) calculating current imaging parameters by transforming earlier imaging parameters by the geometrical transformation, and

d) controlling an imager using the current imaging parameters to generate a series of parallel current diagnostic images.

6.   (Rejected) A tomographic imaging system comprising:
an image-making means for making diagnostic slice images;

a computer that operates the image-making means and calculates imaging parameters that determine particular positions and orientations in three dimensions of image planes of diagnostic slice images made by the image-making means, the computer being programmed to perform the steps of:

receiving at least two earlier reference slice images having a first position and non-parallel orientation relative to each other, the at least two earlier reference images being made using earlier imaging parameters;

controlling the image-making means to make at least two current reference slice images which have the first position and said non-parallel orientation relative to each other;

calculating a geometric transform that transforms the at least two current reference images into alignment with the at least two earlier reference images;

operating on the earlier imaging parameters with the calculated geometric transform to generate current imaging parameters;

controlling the image-making means to generate a plurality of parallel current diagnostic slice images using the current imaging parameters.

7.   (Rejected)   The computer-readable medium as claimed in claim 5, wherein determining the geometrical transform further includes:

with a computer algorithm, maximizing a similarity measure that represents a similarity between the current reference slice images and the earlier reference slice images.

8.   (Rejected)   The tomographic imaging system as claimed in claim 6, wherein

the at least two earlier reference slice images are oriented orthogonal to each other, and

the at least two current reference slice images are oriented orthogonal to each other.

9.   (Rejected)   The tomographic imaging system as claimed in claim 8, wherein a first of the earlier reference slice images and a first of the current

reference slice images are transformed into alignment oriented along one of foot-head, anterior-posterior, and left-right directions and a second of the earlier slice references and a second of the current reference slice images are transformed into alignment oriented along a different one of the foot-head, anterior-posterior, and left-right directions.

10.   (Rejected)   An imaging system for the production of diagnostic slice images of a patient, the system comprising:

an imaging unit which makes at least two current reference slice images of the patient, the current reference slice images being oriented along at least two of head-foot, anterior-posterior, and left-right directions;

a transform unit that determines a geometrical transformation which aligns the current reference slice images and at least two earlier reference slice images that are oriented along the at least two of the head-foot, anterior-posterior, and left-right directions;

a computer programmed to automatically calculate current imaging parameters by transforming earlier imaging parameters by the geometrical transformation and to operate the imaging unit using the current imaging parameters to set a position and orientation of an image plane in three dimensions and to generate a plurality of diagnostic slice images oriented in parallel image planes.

11.   (Cancelled)

12.   (Rejected) The system as claimed in claim 10, wherein the earlier and current reference slice images each include at least two reference slice images oriented parallel to the parallel image planes and at least two reference slice images oriented perpendicular to the parallel image planes.

13.   (Rejected) The system as claimed in claim 12, wherein the earlier reference slice images and the current reference slice images each include at least two reference slice images oriented in a head-foot direction, an anterior-posterior direction, and a right-left direction.

14. (Cancelled)

15. (Rejected) The method as claimed in claim 1, wherein the current reference slice images are orthogonal to each other and the earlier reference slice images are orthogonal to each other.

16. (Rejected) The method as claimed in claim 1, wherein:

the first current and earlier reference slice images are brought into agreement in one of a head-foot direction, an anterior-posterior direction, and a

left-right direction, and

the second current and earlier reference slice images are brought into agreement in a different one of the head-food direction, the anterior-posterior direction, and the left-right direction than the first current and earlier reference slice images, such that the angular offset is 90°.

17. (Rejected) The method as claimed in claim 15, wherein the first and earlier reference slice images are brought into alignment with the head-foot direction and the second current and earlier reference slice images are brought into alignment with the anterior-posterior direction and further including a third current reference slice image and a plurality of third earlier reference slices images and further including:

bringing the third current and earlier reference slice images into alignment with the head-foot direction.

18. (Rejected) The method as claimed in claim 1, wherein a resolution of the first earlier and current reference slice images is different from a resolution of the second earlier and current reference slice images.

19. (Rejected) The method as claimed in claim 1, further including a plurality of first earlier reference slice images and a plurality of second earlier slice images and further including:

25

aligning all of the first earlier and current reference slice images; and aligning all of the second earlier and current reference slice images.

(ix) EVIDENCE APPENDIX

None.

(x) RELATED PROCEEDINGS APPENDIX

There are no related decisions by a Court or the Board in related proceedings.